WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2002CT2B

Title: Water Quality Assessment in Connecticut: Evaluation of Current Protocols and Development of Improved Methods

Project Type: Research

Focus Categories: Non Point Pollution, Surface Water, Water Quality

Keywords: bacteria, nitrogen, trace metals, water quality monitoring

Start Date: 03/01/2002

End Date: 02/28/2003

Federal Funds Requested: $24,835

Non-Federal Matching Funds Requested: $49,960

Congressional District: 3rd

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Abstract

We propose to carry out pilot research to evaluate how temporal variability in stream conditions affects the results of Connecticut's current water quality assessment program. This research will also be useful more broadly in aiding in the interpretation of water quality measurements taken at infrequent intervals. The underlying question that we hope to address is: Given a limited set of measurements of pollutant concentration in a stream, how much can one say about concentrations of that pollutant during unsampled periods? Specific questions that derive from this overall objective are the following:

· Given Connecticut's current sampling scheme, what are the probabilities of making type I and type II errors?

· Given a set of concentration measurements at specific points in time, what is the uncertainty associated with extrapolating these measurements to other times?

· How many samples must be taken in order to reduce this uncertainty to an acceptable level?

· Can the number of samples required be reduced by careful choice of sampling timing (e.g., making sure to cover different flow conditions)?

Our proposal involves collection of a temporally-intensive data set (~200 samples at one site over a 4 month period) to delineate the seasonal, flow-associated, and random variability in levels of bacterial indicators (E. coli, fecal coliform), nitrogen, and trace metals. The proposed site is at the USGS gauging station on the Quinnipiac River in Wallingford, where both streamflow (near-real-time) and water quality data (8 times/year) are available from the USGS. We will compare the use support results and other summary measures obtained from the complete data set to those obtained from subsets of the data. These subsets will be derived from Monte Carlo sampling and will mimic different sampling frequencies (e.g., the

8-12 samples per year associated with the current monitoring scheme). This will allow us to begin to answer the questions outlined above.

Results from this project (and a subsequent, larger research program) will allow CT DEP (and other agencies) to redesign its monitoring programs to obtain the greatest amount of water quality information for the lowest cost. Our results will help provide a clearer picture of the health of the state's streams. They will help to prevent costly errors in the state's list of impaired water bodies, and will ultimately help the state direct its resources to those water bodies in greatest need of protection and restoration. They will also be useful in gaining a better estimate of nitrogen loading to Long Island Sound and a fuller understanding of what sampling frequency is required for accurate assessment of nitrogen loading to the Sound from Connecticut rivers.

We propose to carry out pilot research to evaluate how temporal variability in stream conditions affects the results of Connecticut's current water quality assessment program. This research will also be useful more broadly in aiding in the interpretation of water quality measurements taken at infrequent intervals.

Note that the answer to the first question posed above clearly depends on the measured concentrations: If these greatly exceed WQS on the sampling dates, then it is very likely that the stream is truly impaired, while if measurements exceed WQS only slightly or not on all dates, then the true impairment status of the stream may be more difficult to ascertain. We hope to use the answer to question 2 (an estimate of the uncertainty associated with extrapolation of a given set of measurements) to provide managers with the tools to quantitate the probability of type I and II errors in specific situations.

We will focus our analysis on three types of water quality parameters, namely, indicator bacteria, nitrogen, and trace metals. We will analyze our samples both for E. coli (for comparison to the new water quality standard) and for fecal coliform (for comparison to USGS data).